Tailoring sustainable HCI design knowledge to design practice

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Abstract: The field of Sustainable HCI has grown significantly in recent years, yielding a great body of knowledge about sustainable interaction design. However, this knowledge has led to a similar outcome to many other theoretical contributions in the broader domain of HCI: there are only few examples of its direct application to practice. We looked at design research literature from outside of HCI and gathered insights about the work practice of real-world designers to help uncover potential barriers to transferal. In order to increase acceptance and applicability of Sustainable HCI design knowledge for design practice, we argue that Sustainable HCI researchers have to tailor their theoretical contributions to the application domain's practices in order to reach a broader audience and achieve higher impact. We conclude with recommendations for how to better present and communicate design knowledge to the real world design practitioners.

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ABSTRACT
The field of Sustainable HCI has grown significantly in recent years, yielding a great body of knowledge about sustainable interaction design. However, this knowledge has led to a similar outcome to many other theoretical contributions in the broader domain of HCI: there are only few examples of its direct application to practice. We looked at design research literature from outside of HCI and gathered insights about the work practice of real-world designers to help uncover potential barriers to transferal. In order to increase acceptance and applicability of Sustainable HCI design knowledge for design practice, we argue that Sustainable HCI researchers have to tailor their theoretical contributions to the application domain's practices in order to reach a broader audience and achieve higher impact. We conclude with recommendations for how to better present and communicate design knowledge to the real world design practitioners.

Author Keywords
Sustainable HCI, frameworks, guidelines, design practice.

ACM Classification Keywords
H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

INTRODUCTION

The Sustainable HCI community has produced a variety of contributions since its establishment as an important sub-field in HCI in 2007 [2]. Many of these contributions have been of theoretical nature (e.g., design frameworks or implications) and are put forth to contribute to practical sustainability efforts by informing design. However Sustainable HCI research has run into the same challenge as design research in HCI in general: it is rarely applied to practice [13]. DiSalvo et al. [6] stated that "*there is a significant gap between the professional fields of industrial design and design research in sustainable HCI*". While they acknowledge that this is a problem of HCI in general, it is especially troubling as sustainability is considered to be an important focus across many disciplines and design practice has already taken up the topic of sustainability on their own agenda. Therefore, one has to ask the question: Why is Sustainable HCI design knowledge resulting from the community's research so rarely applied to real-world design practice?

One of the reasons might be that the Sustainable HCI research community publishes its insights *in forms most suitable for consumption by researchers*, and most often *in venues which generally target HCI researchers more than practitioners*. For example, a recent survey of interaction design practitioners [13] offered the following finding: "*When asked about their perceptions of CHI, nearly all stated that they felt it was a conference for academics and graduate students, and is not appropriate for practitioners.*" While the Sustainable HCI research community certainly offers valuable contributions by providing its results in these domains, it should also consider intensifying its efforts to appeal and communicate to application domains. But how can we bridge the gap between Sustainable HCI design knowledge and design practice?

We argue that the Sustainable HCI research community should think about ways to present and communicate its design knowledge to design practice, in addition to the traditional ways of publishing theoretical contributions. In this paper, we tackle this issue by looking at design research literature from outside of HCI and drawing lessons for the Sustainable HCI research community on how to improve and facilitate design knowledge transfer. Based on publications in product design research, industrial design research, and other related disciplines, we identify a set of dimensions of the work practice of real-world designers. We conclude with recommendations for how the Sustainable HCI research community could frame their theoretical contributions in order to foster the real-world applicability and bridge the theory—practice gap.

DIMENSIONS OF DESIGN PRACTICE

We conducted a literature review of design research publications related to the application domains for which we believe Sustainable HCI research findings might be beneficial: product design, industrial design, design engineering, and related disciplines. In particular, we were interested in the processes of design practice as reported by real-world designers in surveys in the field of design

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studies. We were also interested to understand how these less familiar practices differ from the design practices of interaction design better known in HCI. In the following, we highlight different themes in design practice that emerged from our literature research in design practice.

Target Audience

An essential foundation of HCI research is to know the target audience and their practices. As mentioned earlier, Sustainable HCI research is mainly published at HCI venues and as such inherently targeted at Sustainable HCI researchers, but not necessarily to design practitioners. However, assuming that one intent of much of this research is to inform the work of designers, one question that has to be answered is how to tailor a framework or guidelines to designers as a target audience. There are a variety of sub-fields among design practitioners, such as product design, industrial design, design engineering, architectural design, and so on – and while these disciplines share some commonalities, their work practice differs.

Equally important is the question of expertise. A variety of previous Sustainable HCI projects have focused on or called for study of everyday users as designers, such as in do-it-yourself studies, citizen science, or participatory design [e.g., 10, 1, 3]. However, among professional designers from each single design discipline, there are differences in expertise as well which affect design practice and needs. Cross [4] surveyed previous design expertise studies and concluded that novice designers spend more time on the problem definition, as compared to expert designers who focus on developing the solution (problem-focused vs. solution-focused).

Sustainable HCI researchers need to tailor their frameworks to the particular target audience, by considering the intended target discipline and level of expertise, and weighing their implications for the framework itself. For example, if a set of guidelines is targeted towards expert designers, it may be worthwhile to make it most applicable to the later stages in the process, i.e., focus more on providing support for idea generation; when targeting novice designers, additional background information to assist in the problem elicitation stage might prove to be more supportive of their processes.

Stages in the Design Process

In addition to taking the intended target audience into account, the framework needs to be tailored to a specific stage in the design practitioner's typical work practice. As mentioned before, this work practice differs from discipline to discipline; e.g., Cross [5] depicts the design process for product design and design engineering in a simplified model as a four-staged model of exploration, generation, evaluation, and communication. Lawson [11] provides an abstraction for the typical work process in architectural design with his three-stage model of analysis, synthesis, and evaluation. Both authors, however, point out that these models are abstractions that can vary when executed in practice.

For product design, Kruger and Cross [9] present a more detailed eight-stage model that allows us to take a closer look at the possible implications: 1) Gather data, 2) Assess value and validity of data, 3) Identify constraints, 4) Model behavior and environment, 5) Define problems and possibilities, 6) Generate partial solutions, 7) Evaluate solutions, and 8) Assemble a coherent solution. Now, if an HCI researcher were to address an early stage in design the design knowledge should be presented in a different way compared to a later stage. In the first stage, for example, designers gather data, i.e., search for a variety of background information which allows for open-ended frameworks and guidelines. In later stages, for example stage 6, designers generate solutions – and the design knowledge should be integrated into the ideation process, such as in the form of more concrete design principles; in the optimal case these were to be embedded into the requirements and constraints identified in stage 3.

Format and Presentation

Typical Sustainable HCI contributions are often presented as frameworks, guidelines, or design implications in short, concise, and textual format. While this is an established and suitable way to communicate design knowledge within the domain itself, its presentation might be of limited use for practitioners. Previous HCI research has shown that examples provide helpful stimuli for creative thinking [e.g., 8]; but even if a framework were to incorporate such examples, space is often a limitation in typical HCI publications. Additionally these publications are geared towards HCI researchers in the first place, and communication to this audience is a priority. We therefore, suggest that such theoretical contributions be communicated through multiple channels and in multiple forms to address not only HCI researchers but also real-world design practitioners and other application domain experts outside of HCI.

This approach could not only help to distinguish between the potential target audiences, avoiding blurry work in an attempt to serve multiple communities; it would also open up new avenues for communicating design knowledge. Besides textual examples, such as participant quotes often found in HCI research, visual stimuli can be equally, if not more effective; the impact of different stimuli has been subject of various studies in design research [e.g., 7, 12]. The recent addition of the Pictorials track to the DIS 2014 conference[1] is a first step towards enabling such publications that can potentially help to bridge the gap between research and practice.

[1] http://dis2014.iat.sfu.ca/index.php/pictorials/

DISCUSSION

We believe that one important step to bring more Sustainable HCI design knowledge into design practice is to tailor said design knowledge towards designers practices. Sustainable HCI researchers need to be aware of the target audience's processes, needs, and requirements in order to do so. The three dimensions highlighted in this work are only starting points that underline the necessity of understanding the audience we hope to influence with our findings. Depending on the individual case, knowledge about the target audience and its design process might be scarce, thus the Sustainable HCI community can help bridge this gap by connecting communities and sharing knowledge about their practices.

The Sustainable HCI community asks itself why its design knowledge has not been applied to practice on a larger scale, but the real question should be whether the efforts undertaken so far have been enough to yield applicability. As the interview results from Roedl and Stolterman's survey [13] highlight, even interaction designers do not consider the plethora of HCI design work as being targeted at them. We cannot expect that other design disciplines even further away from HCI adapt Sustainable HCI design knowledge. Instead, Sustainable HCI researchers need to bring the knowledge to other fields and communicate it in a way such that it is suitable for their process, applicable to their practices, and present it in their language. Only then can we expect to connect research and practice, broaden the appeal of Sustainable HCI, and strive for higher impact.

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